

## 14.9 Fermentation

Both starch and glucose can be fermented using yeast. Yeast is a fungus which consists of one cell. It grows naturally on the surface of fruits such as grapes and blackberries. The yeast contains enzymes which break down sugars such as glucose to form ethanol.

### Aim

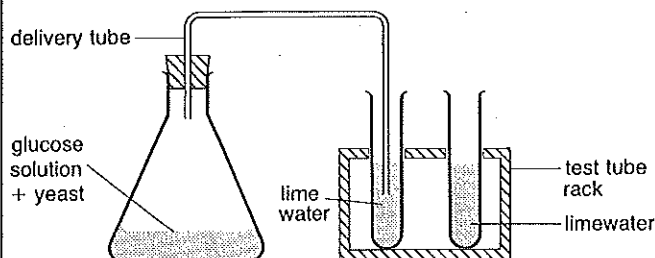
To ferment a solution of glucose with yeast and show that ethanol is produced.

### Apparatus and materials

Conical flask, 100 cm<sup>3</sup> and bung with delivery tube  
Two test-tubes and rack  
Spatula  
Measuring cylinder  
Yeast granules  
Glucose solution, 100 g dm<sup>-3</sup>  
Limewater  
Potassium dichromate(VI) solution  
Dilute sulphuric acid, 2 mol dm<sup>-3</sup>

### Procedure

- 1 Use a measuring cylinder to add 50 cm<sup>3</sup> of glucose solution to a conical flask.
- 2 Add two spatula measures of yeast granules to the glucose solution.
- 3 Swirl the flask to disperse the yeast.
- 4 Fit a bung with a delivery tube to the flask. Dip the delivery tube into a test-tube half full of limewater.
- 5 Place the tube of limewater in a rack. Place another tube of limewater in the rack.



- 6 Leave the apparatus in a warm place for several days.
- 7 Note the appearance of the contents of the flask and the limewater as the fermentation proceeds.
- 8 When the fermentation is complete decant a few cm<sup>3</sup> of the solution into a test-tube. Add an equal volume of potassium dichromate(VI)

solution. Add a few drops of dilute sulphuric acid. Boil the mixture for a minute. Note any change in colour.

### Results

Copy and complete the following table:

day	appearance in flask	appearance of limewater	
		test-tube 1	test-tube 2
1			
2			
3			
4			
5			

Colour of potassium dichromate(VI) + fermented solution before boiling .....

Colour of potassium dichromate(VI) + fermented solution after boiling .....

### Extra work

- Investigate the action of yeast on other sugars such as sucrose and maltose.
- Ferment fruits such as apples, bananas and blackberries. Carry out the experiment quantitatively by absorbing the carbon dioxide in soda lime. Weigh the soda lime tube each day and thus follow the progress of the reaction.

### Questions

- 1 a) What is the purpose of using two test-tubes of limewater?  
b) Describe the appearance of the yeast and glucose solution during the fermentation.  
c) Why is it important to place the 'fermentation flask' in a warm place?  
d) How do you know when the fermentation has finished?  
e) How would you remove the alcohol from the fermented glucose at the end of the experiment?
- 2 What is the maximum volume of carbon dioxide that can be obtained at room temperature and pressure from 72 g of glucose? (44 g of carbon dioxide occupies 24 dm<sup>3</sup> at room temperature and pressure).